MILITARY SPECIFICATION

SPLICE, FIBER OPTIC CABLE

GENERAL SPECIFICATION FOR (METRIC)

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers environmental and nonenvironmental resistant (chemical, mechanical, fusion) splices suitable for military use with cables specified in DOD-C-85045, "Cables, Fiber Optic." Fiber and cable splices specified herein cover a family of general purpose, interconnection hardware providing a variety of compatible optical coupling arrangements.

1.2 Classification.

1.2.1 Military part number. The splices specified herein (see 3.1) shall be identified by military part numbers which shall consist of the basic specification number, slash number of the specification sheet, and a sequentially assigned number as shown in the following example:

D24623	/1	-01
Basic specification number	Specification sheet	Sequentially assigned

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-S-901	-	Shock Tests, H.I. (High Impact); Shipboard Machinery, Equipment and Systems, Requirements for.
MIL-L-17331	-	Lubricating Oil, Steam Turbine and Gear, Moderate Service.
MIL-L-23699	-	Lubricating Oil, Aircraft Turbine Engines, Synthetic Base.
DoD-S-24623/1	-	Splice, Fiber Optic Cable, Fiber Splice (METRIC)
DoD-S-24623/2	-	Splice, Fiber Optic Cable, Fiber Splice Enclosure (METRIC)
MIL-C-55330	-	Connectors, Electrical and Fiber Optic, Packaging of.
DOD-C-85045	-	Cable, Fiber Optic.

STANDARDS

MILITARY

MIL-STD-104	-	Limits for Electrical Insulation Color.
MIL-STD-105	-	Sampling Procedures and Tables for Inspection By Attributes.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Sea Systems Command (SEA 55Z3) Washington, DC 20362 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MILITARY - Continued

MIL-STD-130	-	Identification Marking of U.S. Military Property.
MIL-STD-454	-	Standard General Requirements for Electronic Parts.
MIL-STD-810	-	Environmental Test Methods.
MIL-STD-889	-	Dissimilar Metals.
MIL-STD-1344	-	Test Methods of Electrical Connectors.
DOD-STD-1678	-	Fiber Optics Test Methods and Instrumentations.
MIL-STD-45662	-	Calibration Systems Requirements.

(Copies of specifications and standards required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Specification sheets. The individual splice requirements shall be as specified herein and in accordance with the applicable specification sheets. In the event of any conflict between requirements of this specification and the specification sheets, the latter shall govern.

3.2 Qualification. Fiber optic splices furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids, see 4.4 and 6.3.

3.3 Materials. The splice shall be constructed of materials as specified herein and in the specification sheet (see 3.1). In all cases, materials selected for splice usage shall meet all qualification requirements as specified, and be of a type and quality to assure physical, chemical and optical compatibility with the requirements of this specification. All materials used shall be nontoxic (see 3.3.1), nonnutrient to fungus (see requirement 4 of MIL-STD-454), and manufactured to good workmanship quality (see 3.8). Furthermore, splice materials shall be selected to provide the degree of immunity to nuclear radiation exposure specified in the specification sheet.

3.3.1 Toxic and hazardous products and formulations. The materials used in the splice construction shall not give off toxic or explosive fumes when exposed to flame, nor shall they be of such volatility as to permit a vapor pressure buildup of specified level within the splice enclosure. Elemental mercury or asbestos shall not be used. Materials used shall have no adverse effect on the health of personnel when used for the intended purpose.

3.3.2 Interior parts. The materials used for splice interior parts shall provide 20 years service. No incompatibility shall exist between the materials employed such that degradation of these materials can result from in-service use or from test exposures as specified herein.

3.3.3 Exterior parts. Exterior parts of the assembled splice, if metallic, shall have a passivated finish which permits the attainment of a suitable surface finish condition in accordance with high workmanship standards and shall be compatible with external coatings or platings of the type and color specified in the specification sheet (see 3.1).

3.3.4 Solvents, adhesives, and cleaning agents. If epoxy or comparable cement is used in the splicing processes, no incompatibility shall exist between the materials employed such that degradation of the materials can result from in-service use or when tested in accordance with the requirements of the temperature life test of 3.7.1. The splice manufacturer shall certify their acceptability for long-term use under extended infrared radiation and high temperature conditions. The splice manufacturer shall pack with each splice, as applicable, a list of recommended solvents, adhesives, and cleaning agents for use with the splice.

3.3.5 Liquid materials. The liquid materials shall be utilized over the specified test regimes without need for replenishment. The splice manufacturer shall certify their acceptability for 20-year use under extended infrared and high temperature conditions.

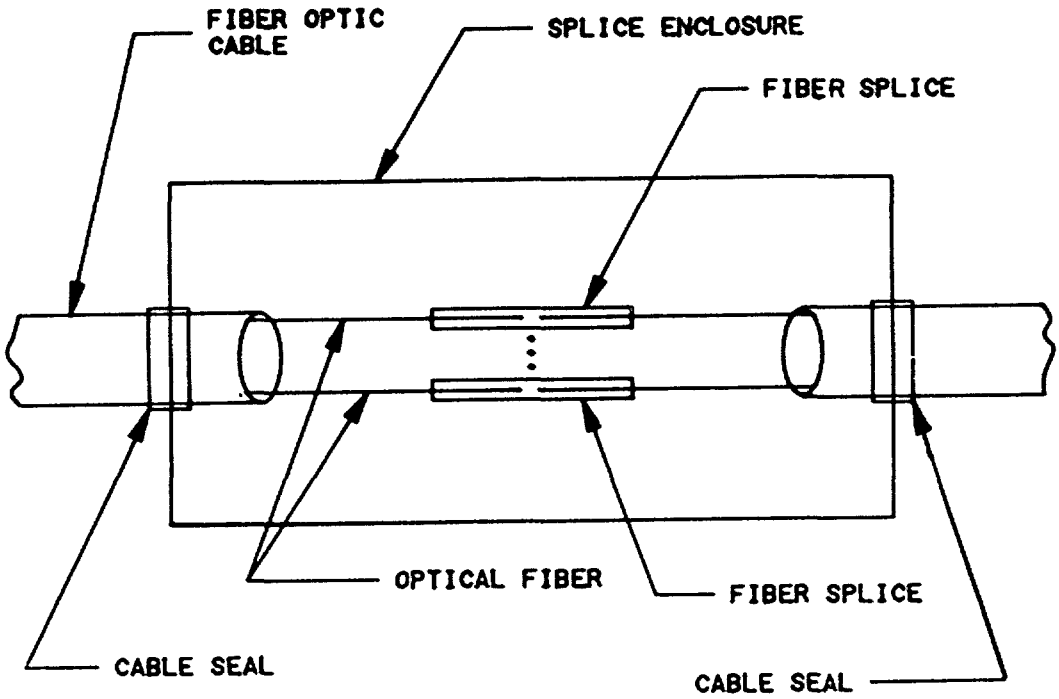

FIGURE 1. Splice assembly.

3.3.6 Fungus-resistant. The materials used in the construction of fiber optic cable splices shall be fungus inert (see requirement 4 of MIL-STD-454).

3.3.7 Recovered materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and shall be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3.4 Design and construction. The splices shall be of the construction, weight, and physical dimensions specified (see 3.1). Figure 1 is an example of a generic splice assembly with splice parts identified.

3.4.1 Detailed requirements. Detailed requirements for the splices specified herein shall include means to accomplish the following:

a. Cable splices shall permanently affix fibers of like sizes, compositions and core refractive index profiles between like cables as specified in accordance with DOD-C-85045 specification sheets.

b. Design shall provide tensile strength continuity between spliced cables without application of the cable tensile load to the spliced fibers.

c. Design shall provide cable strain relief and environmental sealing between the cables and splice to prevent the entry of external agents. The strain relief shall provide protection from both cable tensile forces (3.5.7) and cable axial compressive forces (3.5.8).

d. Design shall meet the requirements for optical, mechanical, and environmental performance as specified herein, or in the specification sheet (see 3.1).

3.4.2 Interchangeability. All splice parts having the same military part number shall be physically and functionally interchangeable without need for modification of such items or of the splicing equipment.

3.4.3 Dissimilar metals. When dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided. The use of dissimilar metal in contact, which tends toward active electrolytic corrosion (particularly brass, copper, or steel used in contact with aluminum or aluminum alloy), is not acceptable. However, metal spraying or metal plating of dissimilar base metals to provide similar or suitable abutting surfaces is permitted. Dissimilar metals shall be defined in MIL-STD-889. In hermetic seals, the 0.25 volt difference between the header material and the housing material is not applicable.

3.4.4 Seals. Seals shall provide environmental isolation for splice interior parts including the optical contact junctions. Grommets, O-rings, boots, gaskets, or other sealing devices as required by the design, shall accomplish their intended purpose and meet all test requirements as specified herein.

3.4.4.1 Optical junction sealing. Optical junctions shall be sealed against moisture, contamination, and mechanical damage as specified herein.

3.4.4.2 Cable sealing. The splices shall seal the cables to meet the environmental requirements specified herein.

3.4.5 Strain relief. The splice enclosures shall accept and retain a cable support or cable strain relief to maintain tensile strength continuity from one cable to the other cable.

3.4.6 Tools. Tools used to splice fibers and cables shall be as specified in the specification sheets (see 3.1). The splice manufacturer shall provide the tools when specified in the acquisition documents (see 6.2).

3.5 Visual and mechanical.

3.5.1 Size. When examined in accordance with 4.5.1.1, the dimensions and dimensional tolerances for the splice parts shall be as specified in the specification sheets (see 3.1).

3.5.2 Mass. When tested in accordance with 4.5.1.2, the mass of the splice parts shall be as specified in the specification sheets (see 3.1).

3.5.3 Color. The color of the splice parts shall be as specified (see 3.1). All background colors shall be solid and in accordance with MIL-STD-104, class 1. Background colors shall be distinguishable when performing the test of 4.5.1.3.

3.5.4 Identification marking. The markings shall be legible and permanent and shall be applied in accordance with MIL-STD-130. When tested in accordance with 4.5.1.4, all marking characters on any face of the splice parts shall be visually identifiable.

3.5.5 Cable seal flexing. When tested in accordance with 4.5.1.5, splice strain relief mechanisms shall prevent loss of environmental sealing or other damage which may impair the splice operation.

3.5.6 Twist. When tested in accordance with 4.5.1.6, a visual examination of the splice enclosure shall reveal no seal impairment nor any other splice damage.

3.5.7 Cable tensile loading. When tested in accordance with 4.5.1.7, a visual examination shall reveal no cracking, splitting, regions of localized tearing or excessive stretching along the splice enclosure.

3.5.8 Axial compressive loading. When tested in accordance with 4.5.1.8, the distance between the fixture clamp and the enclosure or strain relief shall not be less than one-half a cable diameter when the load is applied. A post test visual observation shall reveal no indication of cracking, splitting, tearing or buckling of the splice.

3.5.9 Crush. When tested in accordance with 4.5.1.9, a visual examination of the splice enclosure shall reveal no cracking, splitting, or other effect to permit environmental penetration. Splice enclosure deformation shall not be considered as splice failure.

3.5.10 Impact. When tested in accordance with 4.5.1.10, the impact resistive property of the splice shall be determined by post test visual examination of the splice enclosure. This examination shall reveal no cracking, splitting or other defect to permit environmental penetration. Splice enclosure deformation shall not be considered as splice failure.

3.5.11 Vibration. When tested in accordance with 4.5.1.11, the splices subjected to the specified vibration exposures shall exhibit no visual evidence of loosening of parts, relative motion between splice or cable parts, nor any other damage which can produce physical distortion or wear and may result in fatigue of the mechanical parts or failure of the splice operation.

3.5.12 Mechanical shock. When tested in accordance with 4.5.1.12, the splices shall not be damaged and there shall be no loosening of parts.

3.5.13 Fiber tensile loading. When tested in accordance with 4.5.1.13, the fiber shall not withdraw from the fiber splice (see figure 1 and 6.4.9).

3.6 Optical requirements. The optical requirements shall be used to monitor effects of the inspection requirements specified in 4.3.2, 4.4.1.3, and 4.4.2, and 4.5.2. Center wavelength shall be specified in the specification sheet (see 3.1).

3.6.1 Insertion loss (see 6.4.13). Unless otherwise specified (see 3.1), when measured in accordance with 4.5.2.1, the maximum per channel insertion loss under all conditions shall be 0.5 dB.

3.6.2 Discontinuity (see 6.4.11). When measured in accordance with 4.5.2.2, no discontinuity shall occur. A discontinuity is considered to be a reduction of signal strength of 2 dB or more for a duration of 20 nanoseconds or more.

3.6.3 Analog modulation (see 6.4.10). When tested in accordance with 4.5.2.3, the peak-to-peak analog modulation, bandpass limited to between 4 hertz and 50 kilohertz, shall be more than 1 percent of the steady state signal level.

3.6.4 Pulse distortion (see 6.4.14). When tested in accordance with 4.5.2.4, the rise and fall times of the transmitted optical pulses shall be not more than 0.5 nanosecond longer than the rise and fall times of the incident pulses. The duration of the transmitted optical pulses shall be not greater than 0.5 nanosecond longer than the duration of the incident optical pulses.

3.6.5 Crosstalk (see 6.4.12). When tested in accordance with 4.5.2.5, the signal power levels or sum of levels for devices with 3 or more channels of the passive output channel or channels shall be below the output signal level of the active channel by at least 60 dB.

3.6.6 Ambient optical pickup (see 6.4.9). When tested in accordance with 4.5.2.6, the optical power of the light from the fibers (after accounting for cable losses and optical junction losses between the fiber and the detector) shall be less than -70 dBm (dB ref. to 1 mW).

3.7 Environmental requirements.

3.7.1 Temperature life. When tested in accordance with 4.5.3.1, the splices subjected to these specified accelerated aging exposures shall not exhibit visual evidence of dimensional change, opening of seals, cracking or crazing of components or finishes, identification marking impairment, leakage of waterproofing compounds or other defects detrimental to their operation. No evidence of adhesive degradation shall be present.

3.7.2 Thermal shock. When tested in accordance with 4.5.3.2, a posttest visual examination of the test splices shall reveal no leakage of waterproofing compounds or other apparent loss of sealing capability, no surface or identification marking impairment, nor any damage detrimental to the operation of the splice.

3.7.3 Humidity. When tested to high humidity and cyclic temperature exposures in accordance with 4.5.3.3, the splice parts shall not swell, neither shall they have impaired identification markings, nor shall they degrade such that splice performance is impaired.

3.7.4 Salt spray (corrosion). When tested in accordance with 4.5.3.4, no visible evidence of salt penetration into splice enclosures shall be observed and no corrosive effects shall be seen on the external splice parts.

3.7.5 Water pressure. When tested in accordance with 4.5.3.5, visual inspection of the test splice shall reveal no penetration of indicator dye into the sealed region of the splice.

3.7.6 Fluid immersion. When tested in accordance with 4.5.3.6, visual examination of the splice shall reveal no swelling or softening of material, no loss of sealing capability or identification marking and no discoloration or effects detrimental to the intended use of the splice.

3.7.7 Flammability. When tested in accordance with 4.5.3.7, the time of burning and afterglow removal of the splice enclosure from the flame shall not exceed 3 seconds. The distance of flame travel upward along the splice specimen shall be less than 25 millimeters. Neither violent burning, explosive type fire, nor continued burning of the tissue shall occur when tested in accordance with 4.5.3.7

3.7.8 Ozone resistance. When tested in accordance with 4.5.3.8, the splices shall not show any evidence of loosening or breaking of parts, excessive swelling of resilient materials, or damage to interface seals.

3.7.9 Operating temperature. When tested in accordance with 4.5.3.9, the splice shall not exhibit visual evidence of loss of sealing capability and shall meet the insertion loss requirements of 3.6.1.

3.8 Workmanship. All details of workmanship shall be in accordance with high grade fiber optic splice manufacturing practice when examined in accordance with 4.7. The splices shall be dimensionally uniform and free of manufacturing flaws that would degrade performance after installation, that would inhibit proper connection to interfacing elements, and would otherwise yield an inferior product. The following shall be a minimal level of visual examination to be performed and is not intended to restrict other pertinent workmanship examinations deemed necessary by the contractor.

a. Splice parts which adversely affect the environmental sealing, permit cable sealant penetration into the splice, or degrade the optical fiber alinement shall not be permitted.

b. Cuts, abrasions, holes, bulges, thin spots, peeling or chipping of plating or finish, nicks, burrs, or other substandard surface blemishes shall not be permitted.

3.9 Personnel safety labeling. The splice parts shall be labeled with information describing precautions and safety features as specified in the specification sheets (see 3.1 and 4.7).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be utilized when performing the tests specified herein. The calibration system used to control the accuracy of the measuring and test equipment shall be established and maintained in accordance with MIL-STD-45662.

4.1.2 Inspection conditions. All inspections shall be performed in accordance with the test conditions specified in DOD-STD-1678 or as specified herein.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

Qualification inspection (see 4.3).
Quality conformance inspection (see 4.4).

4.3 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government, on sample units produced with equipment and procedures normally used in production.

4.3.1 Test sample. Fiber optic splice samples complying with the requirements specified herein and in the specification sheets (see 3.1) shall be submitted for qualification certification. The sample shall consist of two sample units for each test listed in group II and two sample units for groups III, IV, V, and VI of table I.

4.3.1.1 Sample unit. A sample unit shall be the parts required to make a completely assembled fiber optic splice submitted for qualification.

4.3.1.2 Sample unit preparation. Except for group I inspection of table I and unless otherwise specified herein, splices shall be fully assembled utilizing two lengths of cable, each two meters long, of the type specified in DOD-C-85045 splice specification sheets. The cable shall contain at least two fibers for those units having the capability to splice more than one fiber. At least two adjacent splices shall be made for each multisplice unit. When optical crosstalk tests are required, crosstalk shall be measured between fibers/splices enclosed in the same sample unit. For group VI, the sample unit shall be a fiber splice not installed in a splice enclosure.

TABLE I. Qualification inspection.

Inspection	Optical tests						Requirement paragraph	Test method paragraph
	Insertion loss (3.6.1)	Discontinuity (3.6.2)	Analog modulation (3.6.3)	Pulse distortion (3.6.4)	Crosstalk (3.6.5)	Ambient optical pickup (3.6.6)		
Group I (all sample units) 1/								
Visual and mechanical							3.3,3.4	4.5.1
Size							3.5.1	4.5.1.1
Mass							3.5.2	4.5.1.2
Color							3.5.3	4.5.1.3
Identification marking							3.5.4	4.5.1.4
Workmanship							3.8	4.6
Personnel safety labeling							3.9	4.7
Optical conformance 2/								
Insertion loss	x 4/						3.6.1	4.5.2.1
Pulse distortion				x			3.6.4	4.5.2.4
Crosstalk					x		3.6.5	4.5.2.5
Ambient optical pickup						x	3.6.6	4.5.2.6
Group II (2 sample units per inspection test) 3/								
Salt spray	a 4/						3.7.4	4.5.3.2
Fluid immersion	a						3.7.6	4.5.3.6
Flammability							3.7.7	4.5.3.7
Impact	a						3.5.10	4.5.1.10
Group III (2 sample units)								
Operating temperature	d 4/						3.7.9	4.5.3.9
Thermal shock							3.7.2	4.5.3.2
Twist							3.5.6	4.5.1.6
Ozone							3.7.8	4.5.3.8
Cable seal flexing							3.5.5	4.5.1.5
Crush	d						3.5.9	4.5.1.9
Humidity	d				a	a	3.7.3	4.5.3.3
Color							3.5.3	4.5.1.3
Identification marking							3.5.4	4.5.1.4
Group IV (2 sample units)								
Temperature life							3.7.1	4.5.3.1
Cable tensile loading	d						3.5.7	4.5.1.7
Axial compressive loading	d						3.5.8	4.5.1.8
Mechanical shock		d					3.5.12	4.5.1.12
Vibration		d	d	d			3.5.11	4.5.1.11
Water pressure	a				a	a	3.7.5	4.5.3.5
Color							3.5.3	4.5.1.3
Identification marking							3.5.4	4.5.1.4

See footnotes at end of table.

TABLE I. Qualification inspection - Continued.

Inspection	Optical tests						Requirement paragraph	Test method paragraph
	Insertion loss (3.6.1)	Discontinuity (3.6.2)	Analog modulation (3.6.3)	Pulse distortion (3.6.4)	Cross-talk (3.6.5)	Ambient optical pickup (3.6.6)		
Group V (2 sample units)								
Temperature life	2/						3.7.1	4.5.3.1
Twist							3.5.6	4.5.1.6
Crush	d						3.5.9	4.5.1.9
Cable tensile loading	d						3.5.7	4.5.1.7
Axial compressive loading	d						3.5.8	4.5.1.8
Vibration		d	d	d			3.5.11	4.5.1.11
Humidity	d				a	a	3.7.3	4.5.3.3
Color							3.5.3	4.5.1.3
Identification marking							3.5.4	4.5.1.4
Group VI (2 sample units)								
Fiber tensile loading	d						3.5.13	4.5.1.13

1/ Visual and mechanical tests listed in this group shall be performed on unassembled splice parts. Assembled splices shall be used on the remaining groups except as specified in footnote 2/.

2/ The temperature life test shall be performed on unassembled parts of the splices to be tested in group V. After the temperature life test, the splice parts shall be assembled in accordance with manufacturer's recommended procedures and subjected to the optical tests of group I and the other inspection tests of group V.

3/ Each sample unit will be tested in only one fluid.

4/ a = Indicates performance test to be accomplished after inspection test.
d = Indicates performance test to be accomplished during inspection test.
x = Indicates that this test applies.

4.3.2 Inspection routine. Splice samples shall be tested in accordance with the test sequence of table I except for groups I and II. In group I, the sequence is not important. In group II, no sequence exists since sample units are exposed to only one test. Optical performance assessments shall be made as specified in table I herein. All sample units shall be subjected to the inspections of group I. Different sample units shall be used for each of groups II, III, IV, V and VI. Group II, III, IV, V and VI testing may be performed simultaneously.

4.3.3 Qualification rejection. Qualification approval will not be granted if any of the splices being tested according to table I fail to meet the requirements of 3.3, 3.4, 3.5, 3.6, 3.7, 3.8 and 3.9. However, the manufacturer may take corrective action. This action must be reported to the qualifying agent who may then impose any further test requirements deemed necessary to assure proper splice performance (see 6.3.1).

4.3.4 Retention of qualification. To retain qualification, the contractor shall forward a report at least every 18 months to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

a. A summary of the results of the tests performed for inspection of product for delivery (groups A and B) indicating as a minimum the number of lots that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for.

b. A summary of the results of the tests performed for periodic inspection (group C), including the number and mode of failures. The summary shall include results of all periodic inspection tests performed and completed during the 18-month period. If the summary of the test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

Failure to submit the report within 30 days after the end of each 18-month reporting period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during the reporting period that the inspection data indicates failure of the qualified product to meet the requirements of this specification. In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during two consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit the products (a representative product of each series, type, and class, etc.) to testing in accordance with the qualification inspection requirements.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the inspections and optical tests specified for group A inspection (table II), group B inspection (table III), group C inspection (table IV), and packaging inspection (see 4.4.3).

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspections.

4.4.1.1 Unit of product. A unit of product shall be one splice (see 6.4.6).

4.4.1.1.1 Inspection lot. The inspection lot shall consist of the number of units of product, offered for inspection at one time, and all of the same design as covered by one specification sheet (see 3.1). All of the units of product in the inspection lot submitted shall have been produced during the same production period with the same materials and processes.

4.4.1.1.2 Sample unit. A sample unit shall be a unit of product selected at random from the inspection lot.

4.4.1.1.3 Sample size. Unless otherwise specified, the sample size shall consist of that number of sample units required by the inspection lot size, as determined by the sampling plans in MIL-STD-105.

4.4.1.1.4 Sample unit preparation. No preparation of the sample units is required for group A inspections. Unless otherwise specified herein, sample unit splices for groups B and C inspections shall be fully assembled utilizing two lengths of cable, each two meters long, of the type in DOD-C-85045 as noted in the splice specification sheet (see 3.1). The cable shall contain at least two fibers for those units having the capability to splice more than one fiber (i.e. multi-splice units). At least two adjacent splices shall be made per unit. When optical crosstalk tests are required, crosstalk shall be measured between fiber/splices enclosed in the same unit. The non-spliced fiber ends of the sample unit shall be optically finished to permit optical assessment of the splice.

4.4.1.1.5 Specimen. A specimen shall be a sample unit that has been prepared in accordance with 4.4.1.1.4.

4.4.1.2 Group A inspection. Group A inspection shall consist of the inspection tests specified in table II. The inspection tests may be performed in any convenient order.

4.4.1.2.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality level (AQL) shall be 1 percent for major defects and 4 percent for minor defects. Major and minor defects shall be as defined in MIL-STD-105.

4.4.1.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units (if possible), and resubmit them for inspection. Resubmitted lots shall be inspected using tightened inspection in accordance with MIL-STD-105. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.4.1.2.3 Disposition of sample units. Sample units that have failed any of the group A inspection tests may be reworked to correct defects if possible and subjected to group A inspection again. Sample units that pass all tests of group A inspection may be delivered on the purchase order or contract or tested to group B inspection (4.4.1.3). Units that have not been corrected shall not be delivered on any order even though the inspection lot submitted is accepted.

4.4.1.3 Group B inspection. Group B inspection shall consist of the inspection tests and optical tests specified in table III, in the order shown, and shall be made on sample units which have been subjected to and have passed the group A inspection.

4.4.1.3.1 Sampling plan. The sampling plan shall be in accordance with MIL-STD-105 for special inspection level S-4. The sample size shall be based on the inspection lot size from which the sample was selected for group A inspection. The AQL shall be 2.5 percent defective.

4.4.1.3.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units (if possible), and resubmit for inspection. Resubmitted lots shall be inspected using tightened inspection in accordance with MIL-STD-105. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.4.2 Periodic inspection. Inspection of product for qualification verification shall consist of the group C inspections, inspection tests, and optical tests specified in table IV in the order shown, and shall be made on sample units which have passed the groups A and B inspections. The periodic inspections shall be used for qualification verification, and except where the results of the inspections show noncompliance with the applicable requirements (see 4.4.2.4), delivery of inspection lots which have passed group B inspections shall not be delayed pending the results of the group C inspections. Group C inspections shall be performed every 18-months following notification of qualification acceptance.

4.4.2.1 Sampling plan. Every 12 months, three sample units which have passed group B inspection shall be selected.

4.4.2.2 Failures. If one or more specimen or sample units fail to pass group C inspection, the sample shall be considered to have failed.

4.4.2.3 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on the contract.

TABLE II. Group A inspection.

Inspection 1/	Optical tests						Requirement paragraph	Test method paragraph
	Insertion loss (3.6.1)	Discontinuity (3.6.2)	Analog modulation (3.6.3)	Pulse distortion (3.6.4)	Crosstalk (3.6.5)	Ambient optical pickup (3.6.6)		
Visual and mechanical							3.3,3.4	4.5.1
Size							3.5.1	4.5.1.1
Mass							3.5.2	4.1.2
Color							3.5.3	4.1.3
Identification marking							3.5.4	4.1.4
Workmanship							3.8	4.6
Personnel safety labeling							3.9	4.7

1/ The tests listed in this group shall be performed on unassembled splice parts.

TABLE III. Group B inspection.

Inspection	Optical tests						Requirement paragraph	Test method paragraph
	Insertion loss (3.6.1)	Discontinuity (3.6.2)	Analog modulation (3.6.3)	Pulse distortion (3.6.4)	Crosstalk (3.6.5)	Ambient optical pickup (3.6.6)		
Thermal shock	b 1/				b	b	3.7.2	4.5.3.2
Twist							3.5.6	4.5.1.6
Cable seal flexing							3.5.5	4.5.1.5
Water pressure	a 1/				a	a	3.7.5	4.5.3.5
Color							3.5.3	4.5.1.3
Identification marking							3.5.4	4.5.1.4

1/ a = Indicates performance test to be accomplished after inspection test

b = Indicates performance test to be accomplished before inspection test

TABLE IV. Group C inspection.

Inspection	Optical tests						Requirement paragraph	Test method paragraph
	Insertion loss (3.6.1)	Discontinuity (3.6.2)	Analog modulation (3.6.3)	Pulse distortion (3.6.4)	Crosstalk (3.6.5)	Ambient optical pickup (3.6.6)		
Temperature life	b 1/			b	b	b	3.7.1	4.5.3.1
Tensile loading	d 1/						3.5.7	4.5.1.7
Axial compressive loading	d						3.5.8	4.5.1.8
Crush	d						3.5.9	4.5.1.9
Mechanical shock		d					3.5.12	4.5.1.12
Vibration		d	d	d			3.5.11	4.5.1.11
Humidity	d				a 1/	a	3.7.3	4.5.3.3
Color							3.5.3	4.5.1.3
Identification marking							3.5.4	4.5.1.4

1/ a = Indicates performance test to be accomplished after inspection test

b = Indicates performance test to be accomplished before inspection test

d = Indicates performance test to be accomplished during inspection test

4.4.2.4 Noncompliance. If a sample fails to pass group C inspection, the contractor shall notify the qualifying activity of the failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, and so forth, and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspection tests or the inspection test which the original sample failed, at the option of the Government). Groups A and B inspections may be reinstituted; however, final acceptance shall be withheld until the group C reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

4.4.3 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be in accordance with the requirements of MIL-C-55330.

4.5 Methods of inspection.

4.5.1 Visual and mechanical examination. The splice or splice parts shall be examined to verify that materials, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.3 and 3.4).

4.5.1.1 Size (see 3.5.1). Each of the dimensions identified in the specification sheet (see 3.1) for the splice parts shall be measured using calibrated measuring devices with the range, precision and accuracy appropriate for the tolerances specified.

4.5.1.2 Mass (see 3.5.2). The splice or splice parts shall be weighed using calibrated scales having the range precision and accuracy appropriate for the tolerances specified.

4.5.1.3 Color (see 3.5.3). The color of the splice or splice parts shall be visually compared with the matching colors in MIL-STD-104.

4.5.1.4 Identification markings. Identification markings on the splice parts shall be visually examined and measured for conformance with the requirements of 3.5.4.

4.5.1.5 Cable seal flexing (see 3.5.5). The splices shall be tested in accordance with method 2017 of MIL-STD-1344. After text exposure, the assemblies shall be visually examined for seal damage.

4.5.1.6 Twist (see 3.5.6). The splices shall be tested as follows: The splice assembly shall be clamped in a fixture capable of rotating ±360 degrees. The untwisted test cables shall be straightened and stretched with minimum tension (about 20 newtons) to their maximum lengths and clamped to the test fixture table top at a distance of about 100 times the cable diameter from the splice. The fixture shall be rotated ±360 degrees at a rate of one cycle per 5 seconds for a total of 50 cycles.

4.5.1.7 Cable tensile loading (see 3.5.7). The splices shall be tested for tensile loading as follows:

a. Tensile loading shall be applied at an approximately linear rate of 2,000 newtons per minute.

b. One-third of the maximum tensile load specified for the and DOD-C-85045 cable being used in the test shall be applied to the splice via the cables. (Any suitable test fixture may be used, provided the assembly length subjected to the tensile load contains the spliced region and that the insertion loss of each of the spliced fibers can be measured while the cable is under tension).

c. Measure the insertion loss.

d. Reduce the tension to zero.

e. The splice exterior shall be visually examined using 3-power magnification.

4.5.1.8 Axial compressive loading (see 3.5.8). Axial compressive loading shall be tested as described herein. If the two ends of the splice assembly are essentially identical, only one end of each splice assembly need be tested.

a. The test cable forming a part of the assembled splice shall be gripped over a length equal to at least 3 cable diameters, starting one cable diameter from the splice enclosure or the strain relief if it is external to the enclosure. The splice enclosure shall be gripped so as not to alter any of its mechanical properties.

b. The gripped cable and splice enclosure shall be forced together along the direction of the cable axis where the cable enters the splice assembly. The force magnitude is a function of cable diameter as listed in table V. Loading and unloading rates are such that the splice is compressively loaded and unloaded linearly in time, with the loading and unloading times each less than 10 seconds. The time spent under full compressive load shall be at least 1 minute. No tensile load shall be applied.

TABLE V. Force magnitude.

Nominal cable diameter	Compressive axial force (newtons)
0mm to 3mm	10
3mm to 6mm	20
6mm to 10mm	50
1cm to 2cm	100
2cm and larger	200

c. Any suitable test fixture may be used provided it properly grips the splice enclosure and cable, allows control and measurement of the applied compressive axial force, and allows visual observation of the region where the cable meets the splice assembly. The test fixture must also allow for the performance of any optical tests called for while the splice assembly is subject to the compressive axial load.

d. With load applied, measure the distance between the fixture clamp and the enclosure or strain relief and measure the insertion loss.

e. Remove the load.

f. Visual observations and examinations shall be made with 3-power magnification.

4.5.1.9 Crush (see 3.5.9). Splices shall be tested for crush loading in accordance with procedure II of method 2040 of DOD-STD-1678. The following special test conditions and modification to procedure II shall apply to these tests:

a. The minimum crush load shall be specified in the specification sheet and shall not be less than 2,000 newtons.

b. The crush loading rate shall be at least 2,000 newtons per minute.

c. Visual inspection of the specimen shall be made under 3-power magnification.

4.5.1.10 Impact (see 3.5.10). Splices shall be tested in accordance with procedure II of method 2030 of DOD-STD-1678. The following special test conditions and modifications to procedure II shall apply to these tests:

a. The radius of the striking surface shall be 12.5 millimeters.

b. Test exposure shall consist of 50 impacts.

c. Visual inspection of the jacket shall be made using 3-power magnification.

4.5.1.11 Vibration (see 3.5.11). Splices shall be tested in accordance with test condition II of method 2005 of MIL-STD-1344.

4.6.1.12 Mechanical shock (see 3.5.12). Splices shall be tested in accordance with grade A, class 1, type B of MIL-S-901.

4.5.1.13 Fiber tensile loading (see 3.5.13). The purpose of this test is to assure that the fiber splice will meet a minimum fiber pullout force. Each fiber of a fiber splice shall be secured into a test fixture by any means which will allow the application of the minimum tensile load to the splice. The minimum load of 5 newtons shall be applied at a maximum rate of approximately one newton per second. The test load shall be held for 15 seconds and decreased at the rate of 1 newton per second.

4.5.2 Optical conformance test methods (see 3.6). Unless otherwise specified, cladding mode stripping devices shall be used when making optical measurements. The mode stripper shall be installed in the test circuit between the source and the splice and between the splice and the detector unless otherwise specified herein. In splices with one, two, or three optical channels, optical measurements shall be made simultaneously on each channel. In splices with four or more channels, optical measurements shall be made simultaneously on three randomly selected channels unless otherwise specified herein.

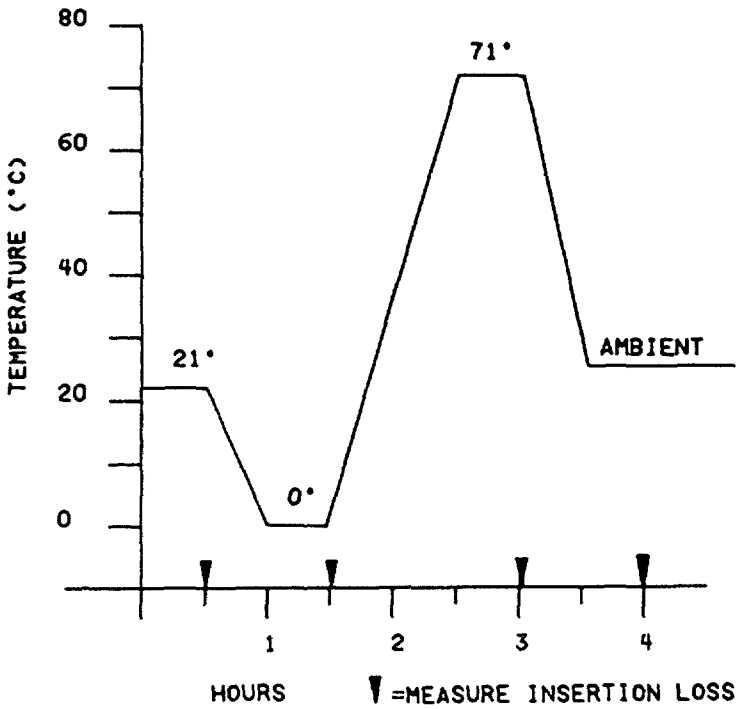

FIGURE 2. Operating temperature range test.

4.5.2.1 Insertion loss (see 3.6.1). An optical power source shall launch light into an optical circuit containing the device under test. The light may be static or modulated as appropriate. P_i is the total optical signal power into the device under test, and P_o is the total optical signal power out of the device under test. The insertion loss in dB is 10 times $\log_{10} (P_i/P_o)$. P_i and P_o are to be determined just to either side of the device under test so that the normal coupling losses associated with the device are included. Corrections shall be made for all losses along the optical circuit between the points where the optical powers are actually measured, and the points where P_i and P_o are to be determined. Since the source, detector, optical waveguide and interconnection characteristics of the optical circuit may change during the course of the test, some control or correction shall insure that the optical loss calculated is due solely to the insertion of the splice. This may be accomplished by providing optical circuit stability or by using data from a reference optical transmission path to correct the data obtained from the transmission path containing the splice.

4.5.2.2 Discontinuity (see 3.6.2). The splice test cables shall be connected to an appropriate optical signal source and detector. Unused ports of the splice, if applicable, shall be opaquely capped. The source shall produce a constant level, static signal easily detected by the detector. The output of the detector shall be monitored for discontinuities while the splice is subjected to a physical test. The detector and monitoring equipment shall possess sufficient sensitivity and high frequency response to detect discontinuities in the optical signal. The monitoring equipment shall include suitable transient capture capability (such as provided by an oscilloscope with an adjustable sweep trigger and oscilloscope camera).

4.5.2.3 Analog modulation (see 3.6.3). The splice test cables shall be connected to an optical signal source and detector. Unused ports of the splice, if applicable, shall be opaquely capped. The source shall produce a constant level, static signal easily detected by the detector. The output of the detector shall be monitored for analog modulation while the splice is subjected to a physical test. The detector and monitoring equipment shall possess sufficient sensitivity and frequency response to discern analog modulation at the acceptance level. The monitoring equipment shall include suitable signal recording capability (such as provided by a triggerable oscilloscope and an oscilloscope camera).

4.5.2.4 Pulse distortion (see 3.6.4). The splice test cables shall be connected to an optical signal source and detector. Unused splice ports, if applicable, shall be opaquely capped. The signal source shall provide a series of optical pulses having maximum rise times and fall times of 1 nanosecond, and pulse durations of approximately 5 nanoseconds. The rise and fall times shall be measured between the 10 percent and 90 percent optical power levels; and the duration, between the 50 percent levels. The optical pulses transmitted by the splice shall be compared with the optical pulses incident on the splice (or other reference pulses known to be of the same shape as the incident pulses). The detector and monitoring equipment shall possess sufficient sensitivity and frequency response to suitably monitor both the incident (or reference) pulses and the transmitted pulses. The monitoring equipment shall also include suitable recording capability (such as provided by an oscilloscope and camera) so that a permanent record of the test data can be obtained.

4.5.2.5 Crosstalk (see 3.6.5). The input to one optical channel (the active channel) is connected via its test cable to an optical signal source, the signal of which may be either continuous or amplitude modulated as appropriate. Cladding mode stripping shall not be utilized. The input to other channels (passive channels) shall be opaquely capped. The output signal power from both the active and passive channels shall be measured. When there is more than one passive channel, the output of all passive channels shall be summed. This test shall be repeated, making each remaining input port the active channel.

4.5.2.6 Ambient optical pickup (see 3.6.6). The far ends of the test cables shall be either opaquely capped or connected to suitable optical power monitoring instruments. Unused splice ports, if applicable, shall be opaquely capped. Cladding mode stripping shall not be employed. The splice shall be (as far as practical) isotropically and homogeneously bathed in simulated sunlight as defined in method 505 of MIL-STD-810. The light shall be broad spectrum with infrared, visible, and ultraviolet components (see 2.2 of method 505), and shall illuminate the splice with an irradiance (power density) of 112 ±5 milliwatts per square centimeter. Light emanating from the optical port(s) of the splice shall be measured by optical power monitoring equipment, having a broad spectral response compatible with the source.

4.5.3 Environmental

4.5.3.1 Temperature life (see 3.7.1). Temperature life exposures shall be in accordance with method 4010 of DOD-STD-1678 and as specified herein. The following special test conditions and modifications to method 4010 shall apply to these tests:

a. The specimen shall be exposed to dry air at 85°C for a period of 250 hours.

b. Only the splice and the portions of the test cables nearest the splice shall be exposed to the test environment.

c. Pretest and post test measurements of the splice outer diameter shall be made and reported.

d. Visual inspection of the splice shall be made using 3-power magnification.

4.5.3.2 Thermal shock (see 3.7.2). The splices shall be tested in accordance with test condition A of method 1003 of MIL-STD-1344. Extreme temperature exposure durations in steps 1 and 3 of method 1003 shall be at least 30 minutes. The extreme low temperature in step 1 shall be -40°C.

4.5.3.3 Humidity (see 3.7.3). The splices shall be tested in accordance with the type II (temperature cycling) procedure of method 1002 of MIL-STD-1344. Optical performance measurements shall be made at the end of each high and low temperature period.

4.5.3.4 Salt spray (corrosion) (see 3.7.4). The splices shall be tested in accordance with test condition B of method 1001 of MIL-STD-1344. After test exposure, the splices shall be externally cleaned and examined for possible salt penetration into the splice watertight areas (the enclosure shall be removed).

4.5.3.5 Water pressure (see 3.7.5). The splices shall be tested for water pressure susceptibility by immersion in an aqueous dye penetrant solution to a depth of 2.0 meters for a period of 48 hours. The solution temperature shall be maintained between 10 and 35 degrees celsius during the exposure period. The dye concentration shall be adequate to visibly indicate liquid exposure. The splices shall be externally cleaned and examined (with enclosures removed) for possible dye penetration into the splice watertight areas.

4.5.3.6 Fluid immersion (see 3.7.6). The splices shall be tested in accordance with method 1016 of MIL-STD-1344 using "mated connector" requirements and the following modifications. Each splice shall be tested to a different immersion fluid. Fluids selected for testing shall be limited to MIL-L-23699 or MIL-L-17331 as applicable. After test exposure, the splices shall be cleaned and examined (with enclosures removed) for possible fluid penetration.

4.5.3.7 Flammability (see 3.7.7). Flammability resistance shall be tested in accordance with method 5010 of DOD-STD-1678.

4.5.3.8 Ozone resistance (see 3.7.8). Cable splice assemblies shall be tested in accordance with method 1007.1 of MIL-STD-1344. After test exposure, the assemblies shall be examined for damage.

4.5.3.9 Operating temperature (see 3.7.9). The purpose of this test is to measure the insertion loss of splices at several temperatures throughout the operating temperature range. Test chamber(s) shall provide the temperature environment over the specified range. (A separate freezer and oven may be used to provide the specified range). The volume of each chamber shall be of sufficient size so that the test sample will not interfere with the generation and maintenance of test conditions. Any heat source shall be located such that radiant heat will not fall directly on the test sample. Thermocouples or equivalent temperature sensors shall be used to determine and control the temperature within each chamber.

a. The splice shall be placed in the test chamber. The cables shall exit the chamber and shall be connected to the optical instrumentation for monitoring of the insertion loss (see 4.5.2.1).

b. The test chamber temperature shall be stablized at 21°C for thirty minutes; insertion loss shall be measured and recorded at the end of this period before the temperature is changed (see figure 2). The temperature of the test chamber shall be lowered to 0°C over a 30 minute period and maintained at that temperature for the next 30 minutes. The insertion loss shall be measured at the end of the 30 minute period while the temperature remains unchanged. The chamber temperature shall be raised to 71°C over a 60 minute period. After the temperature has stabilized at 71°C for 30 minutes and while at that temperature, the insertion loss shall be measured. Decrease the chamber temperature to ambient over a 30 minute period. Allow the chamber to stabilize at ambient temperature for an additional 30 minutes. Insertion loss shall then be measured.

c. Remove the splice from the test chamber. Visually examine, without magnification, the outside of the splice for any damage to the seals or to the enclosure unless otherwise specified (see 3.1).

4.6 Workmanship. The splice parts shall be visually examined to verify that they meet the workmanship requirements of 3.8.

4.7 Personnel safety labeling. The splice parts shall be visually examined to verify that they are labeled with the information required by 3.9.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-C-55330.

6. NOTES

6.1 Intended use. The fiber optic cable splices covered by this specification are intended for use in any application where their performance characteristics are required. The splices are suitable for installation in military use within the limitations of their specified performance requirements.

6.2 Ordering data. Acquisition documents shall specify the following:

a. Title, number, and date of this specification.

b. Specification sheet number, title, and date.

c. Part number.

d. Quantity of splices required.

e. Inclusion of splicing tools, if desired (see 3.4.7).

f. Exception, if any, to the optional provisions of this specification including:

(1) Responsibility for inspection.

(2) Special preparation for delivery requirements, if applicable (section 5).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in Qualified Products List (QPL-24623) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is Naval Sea Systems Command, SEA 55Z3, DOD Standardization Program and Documents Division, Washington, DC 20362; however, information pertaining to qualification of products may be obtained from Defense Electronics Supply Center, DESC-EQ, Dayton, OH 45444.

6.3.1 Provisions governing qualification SD-6. Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

6.4 Definitions. Definitions of terms shall be in accordance with DOD-STD-1678 and as stated below.

6.4.1 Splice. A splice is a generic term for a device which permanently joins optical fibers and cables in a protective manner and may consist of several parts.

6.4.2 Splice enclosure. A splice enclosure is the outermost protective structure of a splice.

6.4.3 Splice junction. A splice junction is the bonded optical interface of mating fibers.

6.4.4 Splice kit. A splice kit consists of all splice parts which are needed to produce a splice.

6.4.5 Splice parts. Splice parts are the individual splicing elements of the splice kit.

6.4.6 Watertight. The watertight property of a splice is its ability to prevent leakage of water into the internal splice parts.

6.4.7 Fiber splice. A fiber splice is that portion of a splice that joins together two fibers and provides physical protection for them.

6.4.8 Cable splice. A cable splice is that portion of a splice that holds together the cable jackets and strength members for purposes of protecting the fibers from physical stresses.

6.4.9 Ambient optical pickup. Ambient optical pickup is the interference of the optical data signals in a splice by ambient optical power incident upon its exterior. The purpose of this optical performance test (3.7.2) is to confirm the ability of a splice to exclude ambient optical power from its optical signal circuits.

6.4.10 Analog modulation. Analog modulation is the dynamic, amplitude modulation of the optical signals transmitted by the splice. The purpose of this optical performance test (3.5.3) is to confirm a splice does not excessively modulate the optical signal when subjected to physical stress tests.

6.4.11 Discontinuity. Discontinuity refers to measuring the presence of relatively sharp, short duration interruptions or drop-outs of the optical signals transmitted by a splice. The purpose of this optical performance test (3.6.2) is to confirm the splice's signal discontinuities are not excessive when subjected to physical stress tests.

6.4.12 Crosstalk. Crosstalk is unwanted, coupled optical energy from an optical signal circuit (the active channel) into another optical signal circuit or group of signal circuits (the passive channels). The purpose of this optical performance test (3.6.5) is to ensure that the splice circuits have adequate optical channel isolation.

6.4.13 Insertion loss. Insertion loss is the total optical signal power loss in an optical circuit caused by inserting a splice into the optical circuit. The purpose of this optical performance test (3.5.1) is to confirm that a splice does not excessively attenuate the optical signal.

6.4.14 Pulse distortion. Pulse distortion is the change in shape of short duration optical pulses transmitted by a splice. The purpose of this optical performance test (3.6.4) is to verify that a splice does not excessively distort the shape or change the duration of the transmitted optical pulses.

6.5 Safety note. Care will be taken when handling the very fine (small diameter) optical fibers to prevent skin puncture or contact of fiber with the eye area. Also, direct viewing of the optical terminal face of a terminated cable, while it is propagating optical energy, is not recommended unless prior assurance has been obtained as to the safe power output level of the terminal.

Custodians:
Army - CR
Navy - SH
Air Force - 85

Review activities:
Army - MI
Navy - AS, EC
Air Force - 11, 17, 19, 80, 99
DLA - ES

User activities:
Army - AR
Navy - CG, MC

Agent:
DLA - ES

Preparing activity:
Navy - SH

(Project 6060-0020)